第二届宝钢学术年会
The Second Baosteel Biennial Academic Conference

Proceedings

of the Second Baosteel Biennial Academic Conference

谢企华　徐乐江　主编
Edited by
XIE Qihua & XU Lejiang

Volume 3

会议主题：技术创新与循环经济
Theme: Technology Innovation and Circular Economy

上海科学技术文献出版社
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编 委 会

Editorial Committee

前　言

两年前的五月，这里曾经举办了首届宝钢学术年会，就“可持续的钢铁，可持续的未来”这一主题，开展了广泛的交流，得到了各界朋友们的大力支持和热情参与，收到了很好的效果，至今我们还记忆犹新。

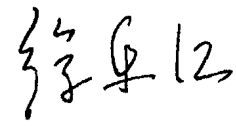
今天，我们再次相聚在黄浦江畔，倍感愉快。本届年会的主题是“技术创新与循环经济”。这是上届年会主题的延伸和深化。在我们国家，正在执行着以人为本，全面、协调、可持续的科学发展观。国民经济新一轮的发展规划，对冶金界的节能降耗和环境保护，提出了更加严格的要求。

两年来，世界粗钢产量连续突破10亿和11亿吨，2005年比2004年又增长5.9%，其中有一半以上出产在亚洲地区；增长的部分几乎全部来自发展中国家。钢铁产品仍然具有十分广阔的市场空间；钢铁仍然是不可替代的工程材料；钢铁仍然对世界经济发展起着举足轻重的作用。

但是，人们也充分意识到，过大的资源消耗与过重的环境负担，已构成钢铁工业可持续发展的制约因素。要缓解这种制约、越过这一瓶颈，就要走节能降耗之路，就要走循环经济之路。要开辟这样的路，就只能靠技术进步与创新，靠技术创新来推动可持续发展。

本届年会共收到国内外作者的技术论文400余篇。经专家认真筛选，将其中的240篇收入本论文集中。论文集共分为3册。

在此，我们衷心感谢论文的作者、年会学术委员会成员、顾问、专家、筹备人员和论文集编辑人员为年会成功召开与论文集出版所做的贡献，因时间仓促，文集中缺点和错误在所难免，期盼大家提出宝贵的意见。



宝钢集团有限公司总经理

PREFACE

Two years ago in May, the first Baosteel Biennial Academic Conference (BAC) was held here, during which extensive exchanges were conducted on the theme of "the sustainable steel the sustainable future". The conference has achieved fruitful results thanks to the energetic support and active participation of friends from all walks of life, which still remains fresh in our memory.

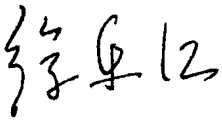
Today, we are delighted to gather again on the riverside of Huangpu River. The theme of this conference is "technology innovation and circular economy", an extension and deepening of the theme of the previous BAC. A comprehensive, harmonious and sustainable scientific outlook on development featuring people first is being implemented in the country. The new round of development planning of national economy puts forward more stringent requirements on metallurgical industry for energy saving, consumption reduction and environmental protection.

The world crude steel output exceeded 1 and 1.1 billion tons respectively in the past two years. The year 2005 witnessed a global output increase by 5.9% over the previous year, almost all coming from developing countries and over half of which was contributed by Asia. There is still a big potential market for steel products; steel remains an irreplaceable engineering material; it still plays a vital role in the economic development of the world.

However, we fully recognize the fact that excessive energy consumption and overburden to the environment have constrained the sustainable development of steel industry. To relax the constraint and overcome the bottlenecks, we need to embark on a road of circular economy featuring energy saving and consumption reduction through technological progress and innovation which propel the sustainable development.

Among the over 400 technical papers contributed by both domestic and overseas authors, 240 of them have been chosen and placed in the proceedings (in three volumes) after a professional and careful selection.

Hereby, heartfelt gratitude is extended to authors, members of the academic committee of the conference, advisors, experts, staff of the preparatory committee and editing team of the proceedings, for their great devotion and contribution to the successful convening of the conference as well as the publication of the proceedings. Due to limitation of the time, the proceedings still have a great potential for further improvement. We are sincerely looking forward to your precious advices.



XU Lejiang

President of Baosteel Group Corporation

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Develop Cycling Economy to Enhance Baosteel's Sustainable Competitiveness

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Abstract: The cycling economy is the new development concept which the human beings have put forward to meet the challenge of issues of resource bottleneck and environmental pollution since 1990's. As a new-type economical state, the cycling economy changes the traditional economical "Resources-Production-Wastes" linear growth mode into the "Resources-Product-Recycled Resources" cyclical development mode. Through the increase in the utilization efficiency of resource, the decrease in the resource consumption and the reduction in the pollution emission, the benign cycle among the ecological system, economical system and social system is realized, thus promoting the coordinated development of the population, resources and environment. The development of cycling economy is beneficial for improving the quality of social economy growth, enhancing the level of social development and strengthening the environmental protection and ecological balance, and thus is just the only road to realization of the sustainable development of the human society. This article analyses the practice of cycling economy in Baosteel, as a reference for steel-makers to explore sustainable development harmonized with nature and society.

Keywords: cycling economy; environmental protection; clean production; energy-saving; recycle

1 The development of cycling economy is the duty-bound social responsibility and inevitable choice of iron and steel enterprises

The cycling economy is an economic growth mode which maintains the focus on the efficient and cyclical utilization of resources, is based on the principle of "Reduction, Recycling and Resource", characterized by low consumption, low emission and high efficiency, and complies with the sustainable development concept. It is the fundamental revolution of the traditional growth mode characterized by "Large Amount of Production, Consumption and Waste". The cycling economy is characterized by: ①The utilization rate of the resource and energy is increased to minimize the consumption and resource and energy in the production process; ② The environmental protection harness is strengthened to eliminate the pollution in the production process as far as possible and minimize the emission of pollutant; ③ The production and technology chain is extended. The waste out of the production and the daily life is recovered to the full. The waste which is recyclable is reclaimed for infinitive times through technical treatment; ④ The waste which the enterprise cannot treat is recovered and disposed centrally to expand the environmental protection industry and resource regeneration industry.

The iron and steel enterprises are the large consumers of resources and energy which use large quantities of resources, such as iron ore, coal, water, electricity, natural gas, etc. The energy consumption of the iron and steel enterprises amounts to 10% of the total energy consumption of the country. The steel output of our country tops the list in the world and has exceeded the sum of the steel output of the United States and Japan. However, China is a country, which is relatively poor in the resources and energy. The iron ore resource is tight in our country and more than a half of the ores for the iron and steel production is imported, which has caused the remarkable increase in the global ore price and freight. Our country is comparatively rich in the coal resource but deficient in coking coal. The water resource of our country is deficient and seriously une-

venly distributed. The per capita possession of water resource is about one fourth of the averaged per capita level of the world and occupies the 82nd place in the world. The iron and steel industry is the large consumer of water. The averaged fresh water consumption per ton of steel is more than twice the world advanced level. The power supply is very tight in different places. The supply of natural gas in deficient and the price is the highest in the world. A large quantity of coal is consumed in the iron and steel production. At the same time, a large volume of pollutants, such as sulphur dioxide, fume, waste water and solid waste, are emitted causing serious environmental pollution. The emitted quantity of dust of the sector amounts to 25% of the total emitted quantity of the industries in China. The emitted quantities of the pollutants, such as fume, sulphur dioxide, waste water, waste slag, take the first place respectively in the different sectors. These problems if are not effectively solved, not only the healthy development of the iron and steel industry of our country will be restricted, but also the irreversely destructive damage to the environment will occur. Therefore, to develop the cycling economy is not only the social responsibility, which the iron and steel enterprise should undertake, but also the objective requirement and inevitable choice of the iron and steel enterprise for meeting the future challenge and keep the sustainable competition advantage.

2 The practice of Baosteel in the development of cycling economy

Since its construction, Baosteel has adhered the guiding thought of sustainable development, aimed at the world advanced level and constantly practiced the development mode of cycling economy.

2.1 Development course of Baosteel cycling economy

The development mode of Baosteel cycling economy has been explored and developed constantly. Initially, Baosteel focused on the last stage harness of the emitted pollutants, such as, dust, SO_2, waste water. On the basis of the last stage harness, Baosteel developed to the realization of the source of the pollutants by reducing the energy consumption to decrease the emission of the CO_2, SO_2, NO_x Pollutants. Then, Baosteel achieved more active source harness through a series of measures of systematic thinking, comprehensively pushing forward the clean production work inside the company, working out the clean production index and clean production promotion plan, perfecting the manufacturing process and improving the material/energy utilization efficiency and green products. Finally, Baosteel has aimed at the most effective resource utilization and environmental protection and taken the load of cycling economy to actively create the strategy of combining the social manufacturing chain and the industrial ecological chain.

2.2 Features and effects of Baosteel cycling economy

By developing the cycling economy, Baosteel has traveled the development road of laying equal stress on economical benefit and social benefit, of laying equal stress on the production development and ecological protection, and achieved the harmony between the green manufacturing of iron and steel, economy and society. In the course of practicing the cycling economy, Baosteel has been making breakthrough constantly. In September, 1996, Baosteel started to establish the environmental management system according to ISO14000 standard. In January, 1998, Baosteel was the first company to obtain the certification of ISO14001 environmental management system in the domestic metallurgical industry. In 2002, the company formally became one of the Chinese industrial tour demonstration points. In May, 2002, Baosteel entered the first group of enterprises which obtained the right to use "the State Water Saving Mark". In January, 2005, Baosteel passed the examination of "the State Environmental-Friendly Enterprise".

2.3 Concrete measures of Baosteel to develop the cycling economy

2.3.1 Aim at the world first-class environmental protection target and increase the environmental protection investment

Since the beginning of the construction of the

plant, Baosteel has established the aim at the world first-class environmental protection target and persisted to use a strategic far sight of sustainable to plan and constructed Baosteel and built Baosteel into a clean factory at internationally advanced level. Baosteel has thoroughly changed the old modes of thought of "first pollution, later harness" and "lay stress on production rather than environmental protection". Baosteel has adhered to the fact that the environmental protection facilities and the major project are designed, constructed and put into operation synchronously. Baosteel has taken the realization of the world first-class environmental protection as an important item in building the world first-class enterprise.

The total investment of the environmental protection facilities relevant to the I, II and III phase projects of Baosteel is RMB 4. 34 billion Yuans, make up to approximate 5% of the total project investment. 316 items of world advanced environmental protection technologies and devices have been adopted in total, including 219 sets of dust removers, 64 sets of water treatment facilities, 26 sets of solid waste disposal and utilization facilities and 7 sets of other environmental protection facilities. Baosteel has given special attention and adopted the advanced technology and equipment, which can effectively save energy and reduce consumption, to control the emission of pollutants from the source and improve the recycle utilization of the resources. In order to reduce the SO_2 emission of the coal-fired power plant, Baosteel introduced the fume desulphurization technology with the world advanced level to carry out the fume desulphurization revamping of No. 2 unit of the self-supply power plant. The project was put into operation in 2005.

In order to ensure the normal operation of the environmental protection facilities and improve the operation effect constantly, Baosteel invests capital for the updating of the environmental protection facilities every year. Since 1996, 284 items of environmental protection facilities updating have been implemented in total with the invested capital of RMB 430 million Yuans.

2.3.2 Strengthen the environmental protection harness and realize the clean production

Baosteel has taken the following technologies and measures in the control of pollutants:

(1) Fume and dust control. Totally 219 large high-efficiency dust removers (including 192 high-efficiency bag collectors, 27 electrical dust removers) have been installed in individual production procedures. In 2005, the emission concentration of the bag collector was controlled to below 20 mg/m^3; the emission concentration of the dry-type electrical dust remover was controlled to below 80 mg/m^3; and the emission concentration of the wet-type electrical dust remover was controlled to below 30 mg/m^3. The emission amount of fume and dust was 0. 86 kg/t.

(2) Reduction in the fried dust in the raw material area. In the raw material area, the following measures are taken, such as, limited height of material pile, chopping of top, remove control spray of water, spray of coagulant, set-up of vessel washing platform, floor cleaning, etc. Different cleaning modes are used for different belt conveyers (The company possesses three invention patents for the belt cleaners). The vacuum suction and pressurization tank is used for the transport of different types of removed dust.

(3) SO_2 control. The sulplur content is strictly controlled in the procurement of raw materials and energy. It is required that the high iron and low sulphur ore blending plan should be used for sintering and that the SO_2 emission should be lower than that of the sintering plant of the same scale. In addition, the research work has been carried out on the desulphurization of the fume from the head of No. 3 sintering machine. As the supply of coal has been tight in recent years, the sulphur content and ash content in the purchased crude coal has a rising tendency with the result that the total SO_2 emission in this year is somewhat increased as compared with 2004. The pile driving and construction of the wet limestone-gypsum fume desulphurization project of No. 2 coal-fired (350 MW) generator unit was started in June, 2004. The desulphurization efficiency of this process

can be up to 95%. The project has now be completed and put into operation. The fume desulphurization project of No. 3 coal-fire (350 MW) generator unit was also started in 2004 and is expected to be completed and put into operation in 2007.

(4) NO_x control. NO_x mainly comes from the process of the fuel combustion. At present, the control measures adopted by Baosteel are mainly the low nitrogen oxide combustion technique. The low nitrogen oxide burner has been employed for No. 3 coal-fire generator unit, the CCPP generator unit (which uses the blast furnace gas as fuel) and a part of heating furnaces in the steel rolling system with 40% reduction of NO_x.

In 2004, the low nitrogen oxide combustion technical reform of No. 1 coal-fired generator unit of the power plant was carried out. The fuel classifying and air classifying combustion technique is adopted. The produced amount of the oxynitride of No. 1 generator unit is reduced by 60%.

(5) Waste water treatment. The individual production units of Baosteel are equipped with the comparatively complete circulating water supply and waste water treatment system, completely realizing the separation of clean water and turbid water. The waste water produced in the individual production unit is first circulated and used after being treated in the production unit. In 2005, the averaged water circulation rater was 97.62%. The waste water treated and discharged after being treated from the iron and steel melting production unit is first considered to be used in series with this system, for example, the clean circulation is discharged to turbid circulation; the turbid is discharged to the coal gas scrubbing water system, and the coal gas scrubbing water is discharged to the slag treatment system. The oil-bearing waste water treated and discharged from the steel rolling production unit flows into the oil-bearing waste water treatment systems of No. 1 and No. 2 central water treatment plant for centralized treatment before the recirculating use, for example, the raw material yard, sintering, blast furnace and road sprinkle. A part of domestic waste water is used for the plantation and as the industrial replenishing water.

2.3.3 Carry out large-scale technical reform and implement the adjustment of the product mix and the harness of the environmental protection of the old enterprises with the result that the process equipment and the environmental conditions of the old enterprises have changed thoroughly

After realizing the joint reorganization with the old iron and steel enterprises in Shanghai area in November, 1998, Baosteel took it as the important task for pushing forward the sustainable development of the enterprise to update the old plants and eliminate the backward production process equipment, with high consumption, high pollution, poor product quality and low labor productivity.

The backward process and equipment of the open-hearth process, copula steel making process, small converter, small electrical furnace and ply rolling and horizontally arranged rolling mill have been eliminated successively. 1.88 Mt of backward iron melting capacity, 3.75 Mt of backward steel making capacity and 4.05 Mt of backward steel rolling capacity have been eliminated.

The large-scale technical reform of the old plate has been implemented, e.g. the stainless steel and carbon steel hot rolled sheet oil updating project of No. 1 Iron and Steel Limited Company. The advanced production process and clean energy has been adopted comprehensively to push forward the clean production and implement the whole-process control of the emission of pollutants.

In combination with Shanghai Municipal three-year action plan and the comprehensive rectification of Wusong Industrial Zone, large amount of capital has been invested to carry out the environmental rectification, reduce the emission of pollutants and improve the ecological environment. In recent years, the investment of No. 1 Iron and Steel Limited Company in respect of the environmental protection has reached almost RMB 800 million Yuans. More than 60 pollution harness projects, large and small, have been completed. The 2 500 m^3 blast-furnace coal-gas residual pressure turbine power generation pro-

ject has been completed. The waste water treatment project has been implemented with the daily treatment capacity of up to 28 000 t. Most of the 1.9 Mt of solid wastes produced every year have been comprehensively utilized. The plantation rate was increased from 8.4% in 2001 to 18.8% in 2005.

No. 5 Iron and Steel Limited Company has invested more than RMB 18 million Yuan for the updating of the heating furnace of the plant to use natural gas instead of heavy oil. It has also invested about RMB 9.8 million Yuan for the dust removal updating of the generating plant. Besides, it has invested more than RMB 50 million Yuan for the large-scale "demolishing the old for plantation". The plantation area has reached more than 700 000 m^2 and the plantation rate has been increased to 25.49%. The project of the 149 industrial furnaces for change to natural gas, for which almost RMB 100 million Yuan was invested, was comprehensively completed in September, 2005.

The environmental quality of this area has been remarkably improved as compared with the condition before updating. The SO_2, smoke dust and industrial dust in air have been reduced by 32%, 79% and 64% respectively. The COD and petroleum-like substance contained in the waste water have been decreased by 63% and 49% respectively.

2.3.4 The whole-process energy management

Baosteel pays great attention to the energy saving and consumption reduction and the energy management work. Through constant practice and gradual exploration, the energy management mode, which is suitable for the concrete conditions of Baosteel, has been formed, namely, the "whole-process energy management". The energy saving and management work have been properly done in every link from the energy conversion, energy media transport and distribution, energy terminal use to the residual energy utilization and recovery. The comparatively satisfactory energy saving effect has been obtained. When the second phase project of Baosteel reached the designed capacity in the overall way in 1993, the ton-steel comprehensive energy consumption was 790 kg of standard coal. After the third phase project was put into operation in 1998, the ton-steel comprehensive energy consumption was reduced to 748 kg of standard coal. In 2003, the ton-steel comprehensive energy consumption reached the historical new level of 675 kg of standard coal, ranging with the world advanced level. The energy index of Baosteel remained at the advanced level in the years of 2004 and 2005.

The main measures of Baosteel in respect of energy management:

(1) Development and utilization of the highly centralized energy management system. The modern energy dispatch and management center is used for the unified balance and the centralized adjustment, distribution and management of 17 kinds of energy media and for the real time coordination of the supply and demand of the energy media between the individual energy units. It has effectively reduced the discharge loss of the system media of energy, decreased the comprehensive energy consumption of Baosteel and increased the comprehensive energy utilization efficiency. In particular, it has reduced the discharge rate of the blast furnace coal gas and the discharge rate of the production sewage water and lessened the environmental pollution of the city. At present, Baosteel has basically achieved zero discharge of coking furnace gas, blast furnace gas and converter gas.

(2) After heat recovery and utilization. The recovery level of the residual energy and afterheat resource of Baosteel has been increased year by year since it was put into operation. In 2005, the total recovery quantity of residual energy and afterheat was up to 1.23 Mt of standard coal. The economical benefit was RMB 760 million Yuan. The ton-steel recovery rate was 95.6 kgce. The main residual energy and afterheat recovery equipment and measures are: dry coke quenching technique (CDQ technique), sintering afterheat recovery technique, blast furnace TRT afterheat power generation technique, converter gas and steam recovery technique, steel pipe loop furnace afterheat recovery furnace, cold rolling afterheat recovery technique, hot rolling evaporation cooling technique.

(3) Strengthen the research and development of new energy saving technique and perform the production procedure energy saving work. The Baosteel has successively developed the blast furnace 200 kg/t coal spraying technique, converter "negative-energy steel making" technique, hot-blast stove afterheat recovery technique, continuous cast slab hot loading and hot transfer technique, large-size oxygen generation energy saving operation technique, protection of furnace by steel-making splash slag technique and iron and steel enterprise system energy saving technique, etc. The development and application of those new energy saving techniques has constantly decreased the production procedure energy consumption of Baosteel and increased the energy conversion efficiency. The research and development of ore blending and coal blending technique has decreased the coal consumption and increased the use proportion of the low cost limonite and the coking weak caking coal, which not only reduces the cost remarkable and promotes the rational utilization of resources.

2.3.5 Conservation and circulation use of water resource

Although it is located near the bank of Yangzi River where the water resource is comparatively abundant, for the purpose of saving the resources of the country and protecting environment Baosteel has aimed at the world advanced level, strengthened the management of water resource, brought it into line with the energy management, effectively carried out the water saving work and made comparatively satisfactory achievements. In 2005, the repeated utilization rate of the industrial water of Baosteel was up to 97.6% and the ton-steel fresh water consumption was 3.77 t.

The main measures of Baosteel in respect of water saving are: recovery and utilization of waste water, implementing a series of water saving techniques of distribution of water resource according to quality, rational use and serial utilization, reduction in the use of fresh water, and saving the water resource as effectively as possible.

(1) Serial utilization technique. On the basis of rationally allocating, controlling water quantity, ensuring the balance of water quantity in the whole system and increasing the circulating rate of the individual systems, the Baosteel circulating water system employs the serial utilization of the discharged water of the individual water systems. That is to say, the discharged waste water of the clean circulating water system is replenished to the turbid circulating water system. The discharged waste water of the turbid circulating system is replenished to the coal gas scrubbing circulating water system. The discharged waste water of the coal gas scrubbing circulating water system is replenished to the slag circulating water system. Finally, the water is absorbed by the slag and evaporated. Thus, zero discharge of the water system has been achieved, without any harm to the environment.

(2) Waste water reuse technique. The waste water resources of Baosteel are various in kind and different in water quality. Previously, the waste water went through the simple treatment to meet the standard before being discharged into the drainage, which not only wasted a large volume of water resource but also impress pressure on the city. The target, which Baosteel is always seeking for, is how to maximize the reuse of the treated waste water most efficiently and replace the water of which the water quality requirement is not high, thus saving the fresh industrial water in taking and reducing the ton-steel water consumption.

Based on its own concrete condition, Baosteel has developed Pinch technique in cooperation. By use of Pinch, the existing waste water of Baosteel has been fully calculated and rationally arranged to work out the waste water reuse optimization plan. Previously, the waste water was not only reused in the raw material and coal yard. Now, the reuse of the waste water has been gradually extended to the users of the limestone yard, dust removal and water spray of general equipment, road and plantation. Some waste water are even reused as the replenishing water. The waste water reuse rate has been up to 75% and above.

(3) Middle water reuse technique. Originally,

the domestic sewage design by Baosteel was directly discharged, without treatment, into the municipal sewage pipe network three the sewage. Since 1998, Baosteel has established and built 26 domestic sewage treatment station with the water treatment capacity of about 3.80 Mt/year. The treated sewage is discharged into the river surrounding the plant via a changed route. In 2001, Baosteel started the research on the middle water reuse technique and succeed in reusing the middle water into the clean circulating water system to replace the industrial replenishing water, thus becoming the first enterprise among the domestic iron and steel enterprises, which has reused the middle water into the industrial system.

2.3.6 Comprehensive utilization of solid waste resource

The development of industrial waste comprehensive utilization technique has been actively carried out. The rolling cylinder slag treatment technique has been developed. The treated slag has good stability and can directly used to build the roadbed and the dam. The blast-furnace slag pulverization technique has been developed. The blast-furnace makes up to 40% of the total solid waste quantity. After being treated, it can be widely used as the concrete raw material for the major projects, such as, Shanghai magnetic levitation transportation project, Lupu Bridge, Shanghai Science and Technology Exhibition Hall and tunnel project, etc. The powdery coal ash utilization technique has been developed. After grounding, the powdery coal ash produced by the power plant every year can be used as concrete raw material and road building material. The cold rolling waste acid technique has been used to produce the hydrochloric acid and iron oxide power, and further the technique for the preparation of high magnetic conductivity ferrite material by use of iron oxide power has been developed. In addition, the technique for the production of cold solid briquette series products by use of the dust-collected power and the technique for the regeneration and utilization of the waste refractory material, etc have been developed. Thus, the solid waste comprehensive utilization rate is almost 100%, reaching or approaching the world advanced level.

2.3.7 Actively develop the "Green Products" represented by the high-efficiency steel product, implemented the "green management" and make contributions to the establishment and development of social cycle economic mode

For a long period of time, Baosteel has adhered to the market orientation and centering around the satisfaction, actively developed the "green product", implemented the "green management", took the road of green development and made efforts to contribute for the establishment and development of the social cycle economic mode.

The water soluble coating has been used to replace the solvent coating, which was generally used in the industry before. By this, Baosteel has become one of the first enterprises, which have developed the new product of electrical steel with the water self-adhesion coating, thus solving the problem of the use of a large quantity of toxic and harmful solvents in the production process.

The zinc-plating and prephosphorized steel plate has been developed. The surface of the plate is covered with the inorganic lubrication film, which can effectively reduce the use of different kinds of organic lubricating substances in the steel plate punching process and reduce the use of cleaning agents, thus lessening the pollution of the environment by the greasy dirt and cleaning agent.

The key problems of the weight reduction of the automobile-used steel sheet. Different types of high-strength steel sheets have been successfully developed, such as, hot-rolled high-strength steel sheet, cold-rolled high-strength IF steel, cold-rolled high-strength low alloy steel, cold-rolled TRIP steel, cold-rolled double-phase steel, cold-rolled baking hardened steel. The thickness of the steel sheet is decreased by the increase in the strength of the steel sheet, realizing the reduction in the weight of the car body and thus the objective of energy saving.

The important new products have been successfully researched and developed, such as, X70, X80

high-strength and high-toughness pipeline steel, HIC-resistant pipeline steel, B40 plastic mould steel, 700 MPa high-strength container-used steel, low-yield-strength-ratio fire-resistant and weather-proof steel, T91 high-pressure boiler pipe, wire rod for steel cord. By using the above-mentioned new products, the user can remarkably reduce the unit steel consumption or extend the lifetime, thus decreasing the use of resource.

3 Baosteel's envisage of pushing forward the cycling economical development during the period of the "Eleventh Five-Year Plan"

The achievement obtained by Baosteel in developing the cycling economy and initiating the green manufacturing over the period of 26 years are obvious to all, but have some difference as compared with the advanced enterprises at home and abroad and the requirement of the city area. Baosteel has established a new round development strategic target, namely, to become a world first-class multinational company, which will take rank with the World Top 500, possess the autonomous intellectual property and strong comprehensive competitive power, enjoy high respect from the society and develop in the way of "one extremely strong business with proper degree of relevant diversification".

To become a public company highly respected by the society, the establishment of a good image of environmental protection is the basic prerequisite. In particular, the important task of Baosteel in the future is how too deal with the contradiction between the expansion of the production capacity and the total emission quantity of pollutants; how to further push forward the development and application of the advanced technologies of clean production, green manufacturing and energy saving and consumption reduction; and how to control and harness such difficult-to-control harmful substances as dioxaanthracene and CO_2 on the base of the continued decrease in the emission of the pollutants, such as, fume and dust, SO_2 and COD. Baosteel must make full use of the accumulated competition advantage and the laid foundation for sustainable development and take the image of the initiator and practiser of the mode of cycling economy mode and the green iron and steel manufacturing enterprises to win the respect of the society.

During the period of the "Eleventh Five-Year Plan", Baosteel will pay more attention to the adoption of the environment-friendly advanced production process and the development and application of new environmental protection techniques, further develop the mode of cycling economy and push forward the development of cycling economy in the following aspects:

(1) In planning the projects, universally adopt the energy-saving and environmental-protection type technological process and equipment and the advanced and practicable pollution source harness technique will be generally adopted to reduce the consumption of resources and energy and the emission of pollutants, and execute the clean production to meet the capacity requirement of the area with the result that an environment-friendly enterprise will be formed. For example, autonomous development of the revolutionary thin strip continuous casting production process and equipment; adoption of the new COREX-MIDREX iron melting process to remarkably reduce the environmental pollution introduced by the adoption of sintering and blast furnace process, etc.

(2) Adopt the different advanced technologies, which are matured now in the world to maximize the recovery and utilization of all the resources and energy, which can be removed and utilized. First, they will be used in the individual procedures of the iron and steel production to reduce the consumption of the resources and energy as far as possible and the industrial chain for the recycle and utilization of the resources and energy will be built jointly with other industries in the area.

(3) Expand the research and application of the new environmental protection and energy saving technologies. For example, technology for dioxaanthrancene monitoring and prevention technology for treatment of industrial waste water by microbe, technology for recovery and utilization heat accumulation and combustion of zinc-bearing dust and heating fur-